

LEAD ABSORPTION IN PRINTING WORKERS

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Key Words : Lead , Printing workers .

امتصاص الرصاص عند عمال المطابع

الخلاصة :

تهدف هذه الدراسة الى تقييم امتصاص الرصاص عند العاملين في المطابع . تم قياس تركيز الرصاص وفعالية انزيم حامض الامينوليفليك اضافة الى الهيموغلوبين في الدم . تم اعتبار بعض العوامل المؤثرة مثل (العمر ، الجنس ، مدة العمل ، الإقامة ، مستوى الرصاص في المعمل ، التدخين ، احتساء الكحول ، نوع العمل) . أظهرت النتائج أن مستوى الرصاص عند عمال المطابع اعلى من الاشخاص الطبيعيين (عمال الالبان) وأن فعالية انزيم حامض الامينوليفليك اقل . اما نتائج الهيموغلوبين فكانت متفاوتة . كما أظهرت النتائج ان درجة امتصاص الرصاص عند عمال المطابع هي ضمن الحد المسموح به عالمياً .

SUMMARY :

The prevalence of Lead absorption among printing workers (risk group) were compaired with dairy products workers (control group) taken into consideration the different variables (age , sex , duration of work , residency , air lead level in the plants , smoking , alcohol drinking , type of job). Blood lead concentration was significantly elevated in the printing workers ($P < 0.01$) with a significant reduction in Delta - amino Levulinic acid dehydratase activity ($P < 0.01$) while the level of Haemoglobin was variable . For both printing and control groups the concentration of blood lead was within the permissible level.

INTRODUCTION :

Lead poisoning is one of the public health problems . Most recent interest lays in the diagnosis , treatment and prevention of lead toxicity in occupationally exposed adult workers ^(1,2,3) . The incidence and severity of such poisoning have decreased substantially during recent years, but much still remains to be done to eliminate lead poisoning completely as an occupational disease ^(4,5) . Therefor , it has been the subjects of intense research in various countries . In Iraq the problem recently investigated by some workers but the reports are few and controversy ^(6,7,8,9) .

Thus , blood lead concentration (PbB) , Delta-amino-laevulinic acid dehydratase activity (ALA-D) and Blood haemoglobin concentration (Hb) were investigated to study the incidence of lead absorption among printing workers (P.W.) .

The study also had taken into consideration the different variables which might have an effect on blood lead level as : Sex , age , smoking, alcohol drinking , residency , lenght of service , type of job and air level in the plants .

MATERIAL AND METHODS :

Clinical material :

The printing workers (P.W.) : Ninety seven p.w. in different areas of Baghdad City were investigated . At the plants all the subjects questioned before the blood samples were obtained . The questionnaire included social and occupational history , personal habits , previous history of lead poisoning and subjective complainets like tiredness , loss of appetite , indigestion , abdominal colics , constipation and were examined for Burton's line . 44 of the workers were employed in 15 private printing offices. Other 53 workers were employed in three governmental printing offices . (Table 1) . The workers were classified into five types (Line type , compositors , pressmen , smelting , and officers.) . All the private printing workers (P.P.W.) were males . While the governmental printing workers (G.P.W.) were 39 males (73.5 %) and 14 females (26.5%) . The mean age of P.P.W. was 44 (range of 17-78 years). While that of the G.P.W. was 31 (range of 15-63 years). The mean age for all p.w. was 37 (range of 15-78

years). The mean of weekly working time was about 42 hours. The mean of duration of exposure was 14.2 years (20.7 for P.P.W. and 8.8 years for G.P.W.).

The Control Subjects : One hundred control workers (C.W.) from the state Enterprise of Dairy products were included in the study for comparison.

They were 80 males and 20 females. Their mean age was 37 years with a range of 15-70.

Specimen Collection : Ten ml. of blood specimens were obtained by venipuncture. The samples were transferred directly to disposable heparinized tubes for blood lead, ALA-D and Hb. determination.

For air sampling ⁽³⁾ general purpose personal samplers (Casella London Limited) were used with a 3.7cm disc holder. The filters used were Whatman glass fiber (GF/A).

METHODS :

Blood lead measurement was done by atomic absorption spectrophotometry using (Pye Unicamp Atomic Absorption spectrophotometer, Series No. 2900). Extraction of lead from the whole blood was done by organic solvents (MIBK and APDC), using three different concentrations of lead standard solutions, (25, 50 and 100 ug/100ml.) for calibration. All specimens were analysed in duplicates ⁽¹⁰⁾. ALA-D activity in whole blood was determined by the recommended colorimetric method of Burch, H.B., and Siegel (1971) ⁽¹¹⁾. While Hb & PCV were determined by Coulter Counter, model S-Plus, Fully Automatic machine (Coulter Electronics, INS Hialeah Florids, USA).

STATISTICAL METHOD :

The analysis of variance and F- test were used to test the effect of different variables on the mean values of the different parameters. Student's t-test was also used to test the statistical difference between two means, and the correlation coefficient (r) was used to examine the possibility of any correlation between the different parameters.

RESULTS :

The results of (P.W.) were compared with those from (C.W.) and are

summarised as follows : The mean PbB for (P.W.) was found to be significantly higher than that of the (C.W.) $P < 0.01$, while the mean ALA-D was significantly lower $P < 0.01$. The mean Hb showed no significant difference (Table 2) . Twenty four percent of the (P.W.) showed PbB between 10-19 ug/100 ml., 63% between 20-29 ug/100 ml ., 10% between 30-39 ug/100 ml and 3% above 40 ug/100 ml . While in the (C.W.) , the majority (57%) showed PbB between 10-19 ug/100 ml . The highest percentage of (P.W.) had ALA-D between 100-124 u/ml RBC, while the highest percentage of (C.W.) lie between 200-225 u/ml RBC. Table 3 and 4 shows the effect of the different parameters on the PbB and ALA-D for (P.W.) (the result of the Hb was not included in the table because there was no significant difference in Hb according to the different variables studied except for sex). Male (P.W.) had higher PbB than females , but the difference was statistically not significant , while female workers showed higher activity of ALA-D than males , which was also not significant . Cigarette smokers and alcohol drinkers showed a significantly higher PbB than nonsmokers and nonalcohol drinkers respectively , with a significant reduction in ALA-D activity . Neither the residency nor the length of service (in years) or weekly hours had a significant effect on lead absorption parameters . The group of workers with previous exposure showed significantly higher PbB than those without previous exposure . The mean values of PbB for workers in private and governmental printing plants showed no significant difference . While there was a significant difference regarding ALA-D . PbB was found to be higher in those workers in smelting departments among the other workers of different department , but statistically was non significant . The correlation between PbB and air lead (PbA) in the plants was highly significant . But no significant correlation was found between PbA and ALA-D , and no correlation between PbA and Hb was detected . (Fig. 1) .

TABLE 1 : The printing offices and their satiation in Baghdad City :

Private printing offices:	No of Offices :	No of Workers:
AL - Mutanabbi street	8	44
AL - Battaween	5	
Al - Midan Square	2	
Total	15	
Governmental printing offices :		
The Labourer Central printing offices	I	
The University Of Baghdad printing Offices	I	
Dar- AL - Hurriah printing offices Number 2.	I	
Total	3	

TABLE 2 : Mean $\pm$ SD of PbB concentration , ALA-D activities and Hb concentration for printing workers and control subjects .

groups	N	PbB ug/dl	ALA-D u/mIRBC	Hb gm/dl.
Printing workers	97	23.6 $\pm$ 6.3	141.4 $\pm$ 38	15.2 $\pm$ 1.08
Range		12 - 52	39 - 207	11.4 - 16.8
Control subjects :	100	16.9 $\pm$ 9.3	198 $\pm$ 29	15.0 $\pm$ 1.10
Range		5 - 38	119 - 285	11.9 $\pm$ 17.10
P		< 0.01	< 0.01	> 0.05

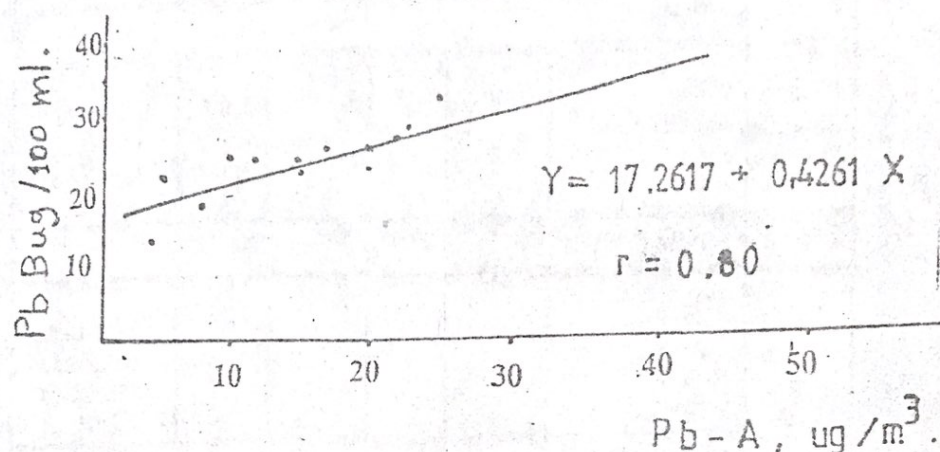
Table 3 : Mean $\pm$ SD of PbB and ALA-D for printing workers according to sex, age, smoking habit and alcohol consumption.

Groups	N	PbB ug/dl	ALA-D u/ml RBC
Sex :			
Male	83	23.9 $\pm$ 6.6	139.3 $\pm$ 39.0
Female	14	21.7 $\pm$ 4.1	153.0 $\pm$ 32.0
P		> 0.05	> 0.05
Age (Yrs) :			
< 20	18	21.0 $\pm$ 4.5	173.5 $\pm$ 26.0
20 - 29	21	22.0 $\pm$ 5.2	158.6 $\pm$ 42.0
30 - 39	13	26.0 $\pm$ 5.8	111.4 $\pm$ 28.0
40 - 49	21	22.9 $\pm$ 6.4	140.3 $\pm$ 39.0
50 -	24	26.2 $\pm$ 8.7	119.3 $\pm$ 35.0
P		< 0.05	< 0.05
Smoking habit :			
Smokers	44	25.2 $\pm$ 7.0	123.0 $\pm$ 39.0
Non smokers	53	22.3 $\pm$ 6.0	156.0 $\pm$ 37.0
P		< 0.05	< 0.01
Alcohol consumption :			
Alcoholic	33	26.3 $\pm$ 7.2	120.7 $\pm$ 35.0
Non alcoholic	64	22.2 $\pm$ 5.9	152.0 $\pm$ 41.0
P		< 0.01	< 0.01

Table 4 : Mean + SD of PbB concentration and ALA-D activity according to residency, length of service, weekly working hours, history of previous exposure to lead and type of jobs.

Groups	N	PbB ug/dl	ALA-D u/ml RPC
Residency :			
Urban	66	23.8±7.5	136.0±42.0
Suburban	29	22.8±4.5	154.0±39.0
Rural	2	26.0±0.0	118.0±30.0
P		> 0.05	> 0.05
Length of service (Yrs) :			
< 2	31	23.9±6.9	152.4±44.4
2 - 6	12	22.1±4.0	147.0±46.0
> 6	54	23.8±7.0	133.6±37.0
P		> 0.05	> 0.05
hrs / Week :			
≤ 24	9	27.1±2.7	114.0±24.0
35 - 36	9	23.3±5.2	135.1±34.0
> 36	79	23.2±7.0	145.0±43.0
P		> 0.05	> 0.05
History :			
With previous exposure	24	26.1±5.0	128.6±38.0
Without previous exposure	73	22.8±6.9	145.5±42.0
P		< 0.05	> 0.05
Job :			
Lino type	23	24.4±5.4	146.8±91.0
Compositers	32	23.7±8.0	141.6±45.0
pressmen	14	22.4±5.8	139.0±43.0
Smelting	4	31.7±7.7	123.7±31.0
Offices workers	24	22.0±7.2	140.2±38.0
P		> 0.05	> 0.05

Fig.I , Correlation between mean blood lead level (Pb-B) of workers in 12 printing plants and the mean lead - in - air concentration (Pb-A) in these plants .



DISCUSSION :

The upper acceptable limit of PbB for exposed workers is a matter of controversy ^(12,13,14) . However , both the world Health Organization (WHO) and the US Occupational Safety and Health Administration (OSHA) have recommended that 40 ug/100 ml should be considered as an action limit ⁽¹⁵⁾ . Three of our (P.W.) only 3.1% had PbB above 40 ug/100 ml . While 96.9% of them had PbB less than 40 ug/100 ml . Inspite the significant difference in the mean PbB between the (P.W.) and the (C.W.) , in general they were still within the acceptable range . The presence of a high percentage of the (P.W.) who had a blood lead level within the permissible limit , is probably attributed to the lower degree of pollution as indicated by air lead in the printing plants . Our results are therefore contrary to those previously reported ⁽⁸⁾ on 9 Iraqi printing workers (mean PbB = 63 ± 15.1 ug/100 ml.) . However , they are good agreement with the work of Hassan ⁽⁶⁾ , which was done on 16 printing workers (mean = 19.04 ± 12.61 ug/100 ml) . Therefore, the measurement of ALA-D in this study and for the first time , could be more informative for establishing lead absorption in such a group of workers . The lower ALA-D among the printing workers in comparison with the control workers (Table 2) is in agreement with previous reports ^(16,17,18,19) . This partial depression

of ALA-D activity is clearly indicates that lead absorption does exist in the (P.W.) group . This finding confirms that ALA-D is a sensitive indicator for evaluating lead exposure at low and moderate levels (20). The significant difference in Hb between the (P.W.) and the (C.W.) and the absence of significant correlation between Hb and PbB in the (P.W.) and the (C.W.) were similar to the results obtained by others^(21,22). Those results support the view of Zielhuis⁽²³⁾, that Hb estimation could be used for preventive purposes and not for diagnosis of lead poisoning, because the effect of lead on Hb occurred at PbB of about 50 ug 100ml. Many reports suggested^(24,25) that lead content in human blood varies with age and sex. It tends to increase with age and males have more lead than females. The present finding revealed no serious effect of sex factor on the different parameters of lead absorption (Table 3); while they confirmed the effect of age. The increased PbB in cigarette smokers among (P.W.) could probably be attributed to the contamination of the fingers and cigarette and or / impaired lung clearance mechanism. The difference in PbB between alcohol drinkers and non drinkers (P.W.) supports the suggestion that increased lead absorption among some drinkers may be explained by increased lead absorption among some drinkers due to the possible synergistic action between lead and alcohol⁽²⁶⁾.

Reserchers from Germany and Iraq^(27,28), in their studies on the general population found higher PbB values in urban than suburban and rural areas. No significant comparable results were obtained in this study. The possible explanation for this finding is that; despite those workers had different residence, however their sites of work was in the urban area.

The duration of work (length of service) in the trade seemingly had no significant effect on the different parameters of lead absorption. Thus this finding could indicates no significant exposure while (P.W.) who had previous exposure had significantly higher level of PbB than those with no such exposure. This finding is in consistence with the results obtained previously⁽²⁹⁾. Additional exposure which was found in three (P.W.) only had no significant effect on the different parameters and this could be explained on the bases that weekly working hours had no effect on these parameters. The PbA level in the printing plants pointed out the level of exposure was low, and this

was in agreement that obtained by others⁽³⁰⁾. Also there was no significant difference in PbA between the private and the governmental printing plants in spite of the dissimilar hygienic conditions. This suggests no need for monitoring PbA in printing industries. However; the higher PbB in those who are working in lead smelting compared with other workers could be attributed to the direct lead fumes inhalation.

The conclusions out of this study is this type of exposure may not carry a serious risk among the printing workers. Nevertheless, despite the size number of C.W. was low, the results clearly indicated that PbB concentration in Iraqi population still lower than the permissible documented by the European Health and Safety Commission⁽⁵⁾.

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